U.S. FISH AND WILDLIFE SERVICE
SPECIES ASSESSMENT AND LISTING PRIORITY ASSIGNMENT FORM

SCIENTIFIC NAME: *Chamaesyce remyi* var. *remyi*

COMMON NAME: `Akoko

LEAD REGION: Region 1

INFORMATION CURRENT AS OF: July 2005

STATUS/ACTION:

___ Species assessment - determined species did not meet the definition of endangered or threatened under the Act and, therefore, was not elevated to Candidate status

___ New candidate

__X_ Continuing candidate

___ Non-petitioned

__X_ Petitioned - Date petition received: May 11, 2004

_ 90-day positive - FR date:

_X_ 12-month warranted but precluded - FR date: May 11, 2005

_N_ Did the petition request a reclassification of a listed species?

FOR PETITIONED CANDIDATE SPECIES:

a. Is listing warranted (if yes, see summary of threats below)? _yes

b. To date, has publication of a proposal to list been precluded by other higher priority listing actions? _yes

c. If the answer to a. and b. is "yes", provide an explanation of why the action is precluded. We find that the immediate issuance of a proposed rule and timely promulgation of a final rule for this species has been, for the preceding 12 months, and continues to be, precluded by higher priority listing actions. During the past 12 months, most of our national listing budget has been consumed by work on various listing actions to comply with court orders and court-approved settlement agreements, meeting statutory deadlines for petition findings or listing determinations, emergency listing evaluations and determinations and essential litigation-related, administrative, and program management tasks. We will continue to monitor the status of this species as new information becomes available. This review will determine if a change in status is warranted, including the need to make prompt use of emergency listing procedures. For information on listing actions taken over the past 12 months, see the discussion of "Progress on Revising the Lists," in the current CNOR which can be viewed on our Internet website (http://endangered.fws.gov).

___ Listing priority change

Former LP: ___

New LP: ___

Date when the species first became a Candidate (as currently defined): 1980

___ Candidate removal: Former LP: __

___ A – Taxon is more abundant or widespread than previously believed or not subject to

the degree of threats sufficient to warrant issuance of a proposed listing or continuance of candidate status.

___U – Taxon not subject to the degree of threats sufficient to warrant issuance of a proposed listing or continuance of candidate status due, in part or totally, to conservation efforts that remove or reduce the threats to the species.

___ F – Range is no longer a U.S. territory.

___ I – Insufficient information exists on biological vulnerability and threats to support listing.

___ M – Taxon mistakenly included in past notice of review.

___ N – Taxon does not meet the Act's definition of "species."

___ X – Taxon believed to be extinct.

ANIMAL/PLANT GROUP AND FAMILY: Flowering plants, Euphorbiaceae (Spurge family)

HISTORICAL STATES/TERRITORIES/COUNTRIES OF OCCURRENCE: Hawaii, island of Kauai

CURRENT STATES/ COUNTIES/TERRITORIES/COUNTRIES OF OCCURRENCE: Hawaii, island of Kauai

LAND OWNERSHIP: Populations are found on State and private lands.

LEAD REGION CONTACT: Paul Phifer, 503-872-2823, paul_phifer@fws.gov

LEAD FIELD OFFICE CONTACT: Pacific Islands Fish and Wildlife Office, Christa Russell, 808-792-9400, christa_russell@fws.gov

BIOLOGICAL INFORMATION:

Species Description *Chamaesyce remyi* var. *remyi* is a perennial shrub. Stems are erect to scandent, 0.3 to 2 meters (1 to 6.6 feet) long, with flowering branches 1 to 6 millimeters (0.04 to 0.24 inches) in diameter. Leaves are oppositely arranged with each succeeding pair set at right angles to the preceeding pair, elliptic to oblong or broadly lanceolate, 35 to 165 millimeters (1.4 to 6.5 inches) long, and 15 to 75 millimeters (0.6 to 3 inches) wide. Inflorescences are cyathia that are solitary with glabrous capsules protruding well beyond the top. Seeds are white to brown, 2 to 3 millimeters (0.08 to 0.12 inches) long, and smooth to shallowly rugose (Wagner *et al.* 1999a).

Taxonomy *Chamaesyce remyi* var. *remyi* was described by L. Croizat and O. Degener. This species is recognized as a distinct taxon in Wagner *et al*. (1999a) and Wagner and Herbst (2003), the most recently accepted Hawaiian plant taxonomy.

Habitat *Chamaesyce remyi* var. *remyi* is found in wet *Metrosideros polymorpha-Dicranopteris linearis* montane mesic forest with *Antidesma platyphyllum, Bobea* sp., *Cibotium* sp., *Dicranopteris linearis, Melicope* sp., and *Pittosporum*sp., and in undisturbed lowland rain forest or wet ridges with *Acacia koa, Bidens* sp., *Cyanea* sp., *Exocarpos luteolus, Leptechophylla*

tameiameaie, *Lysimachia* sp., *Myrsine* sp., *Psychotria* sp., *Psydrax odorata*, *Santalum* sp., and *Sida* sp., at elevations between 183 to 1,110 meters (600 to 3,640 feet) (Hawaii Natural Heritage Program Database 2004).

Historical and Current Range/Current Status *Chamaesyce remyi* var. *remyi* is known from at least 10 populations totaling 500 to 1,000 individuals (Steve Perlman, Dave Lorence, and Ken Wood, National Tropical Botanical Garden, pers. comms. 1996; K. Wood, pers. comm. 2005). This variety is found only on the island of Kauai (Koutnik 1990). Hybrids of *C. remyi* and *C. sparsiflora* have been found near the margins of Wahiawa Bog, Kauai (Wagner *et al*. 1999a).

THREATS:

A. The present or threatened destruction, modification, or curtailment of its habitat or range. *Chamaesyce remyi* var. *remyi* is threatened by feral goats (*Capra hircus*) and pigs (*Sus scrofa*) (S. Perlman and K. Wood, pers. comms. 1996). As early as 1778, European explorers introduced livestock, which became feral, increased in number and range, and caused significant changes to the natural environment of Hawaii. Past and present activities of introduced alien mammals are the primary factor altering and degrading vegetation and habitats on Kauai. The goat, a species originally native to the Middle East and India, was successfully introduced to the Hawaiian Islands in 1792. Currently, populations exist on Kauai, Oahu, Maui, and Hawaii. On Kauai, feral goats have been present in drier, more rugged areas since the 1820s and they still occur in Waimea Canyon and along the Na Pali Coast, as well as in the drier perimeter of Alakai Swamp and even in its wetter areas during periods with low rainfall. Goats browse on introduced grasses and native plants, especially in drier and more open ecosystems. Feral goats eat native vegetation, trample roots and seedlings, cause erosion, and promote the invasion of alien plants. They are able to forage in extremely rugged terrain and have a high reproductive capacity (Clarke and Cuddihy 1980; Cuddihy and Stone 1990; Culliney 1988; Scott *et al*. 1986; Tomich 1986; van Riper and van Riper 1982). This species is threatened by direct damage from feral goats, such as trampling of plants and seedlings and erosion of substrate (Clarke and Cuddihy 1980; Culliney 1988; Scott *et al*. 1986; van Riper and van Riper 1982).

The pig is originally native to Europe, northern Africa, Asia Minor, and Asia. European pigs, introduced to Hawaii by Captain James Cook in 1778, became feral and invaded forested areas, especially wet and mesic forests and dry areas at high elevations. They are currently present on Kauai and four other islands, and inhabit rain forests and grasslands. While rooting in the ground in search of the invertebrates and plant material they eat, feral pigs disturb and destroy vegetative cover, trample plants and seedlings, and threaten forest regeneration by damaging seeds and seedlings. They disturb soil and cause erosion, especially on slopes. Alien plant seeds are dispersed on their hooves and coats as well as through their digestive tracts, and the disturbed soil is fertilized by their feces, helping these plants to establish. Pigs are a major vector in the spread of many introduced plant species (Medeiros *et al*. 1986; Scott *et al*. 1986; Smith 1985; Stone 1985; Tomich 1986; Cuddihy and Stone 1990; Wagner *et al*. 1999a).

Pig and goat exclusion fences protect two of the ten known populations of this species; however, without continued monitoring and maintenance of those fences, pigs and goats from surrounding

areas can easily access fenced areas. In addition, the remaining, unfenced individuals of this taxon are still impacted by feral ungulates.

B. Overutilization for commercial, recreational, scientific, or educational purposes.
None known.

C. Disease or predation.
Minor damage has been observed from an introduced insect, the two-spotted leafhopper (K. Wood, pers. comm. 1996). The two-spotted leafhopper (*Sophonia rufofascia*) causes feeding damage on leaves, typically in the form of stippling and yellowing. In addition to mechanical feeding damage, this insect may introduce a plant virus. It is suspected of causing severe dieback of the native fern *Dicranopteris linearis* (uluhe) and economic damage to crops and ornamental plants in Hawaii (Adam Asquith, U.S. Fish and Service, pers. comm. 1994). Currently, there is no effectively known control method for this threat.

D. The inadequacy of existing regulatory mechanisms.
Pigs and goats are managed in Hawaii as game animals, but many herds populate inaccessible areas where hunting has little effect on their numbers (Hawaii Heritage program 1990). Pig and goat hunting is allowed year-round or during certain months, depending on the area (Hawaii Department of Land and Natural Resources n.d.-a, n.d.-b, n.d.-c, n.d.-d). However, public hunting does not adequately control the number of pigs and goats to eliminate this threat to native plant species. Ungulate exclusion fences protect two of the ten known populations of this species; however, without continued monitoring and maintenance of those fences, pigs and goats from surrounding areas can easily access fenced areas. In addition, the remaining, unfenced individuals of this taxon are still impacted by feral ungulates.

E. Other natural or manmade factors affecting its continued existence.
Alien plant species threaten this species. Although the exact pest species that threaten this plant have not been identified, alien pest plants are found throughout the areas where this species occurs. The original native flora of Hawaii consisted of about 1,400 species, nearly 90 percent of which were endemic. Of the total native and naturalized Hawaiian flora of 1,817 taxa, 47 percent were introduced from other parts of the world, and nearly 100 species have become pests (Smith 1985; Wagner *et al*. 1999a). Several studies (Cuddihy and Stone 1990; Wood and Perlman 1997; Robichaux *et al*. 1998) indicate nonnative plant species may outcompete native plants similar to *Chamaesyce remyi* var. *remyi*. Competition may be for space, light, water, or nutrients, or there may be a chemical inhibition of other plants (Smith 1985; Cuddihy and Stone 1990). In addition, nonnative pest plants found in habitat similar to that of this species have been shown to make the habitat less suitable for native species (Smathers and Gardner 1978; Smith 1985; Loope and Medeiros 1992; Medeiros *et al.* 1992; Ellshoff *et al.* 1995; Meyer and Florence 1996; Medeiros *et al.* 1997; Loope *et al*. 2004). In particular, alien pest plant species modify habitat by modifying availability of light, altering soil-water regimes, modifying nutrient cycling, or altering fire characteristics of native plant communities (Smith 1985; Cuddihy and Stone 1990; Vitousek *et al*. 1987). Because of demonstrated habitat modification and resource competition by nonnative plant species in habitat similar to the wet *Metrosideros polymorpha-Dicranopteris linearis* montane mesic forest habitat of *C. remyi* var. *remyi*, the Service believes

nonnative plant species are a threat to *C. remyi* var. *remyi*. Nonnative plants are being controlled in two of the ten known populations of this species, but will probably never be completely eradicated because new propagules are constantly being dispersed into the fenced areas from surrounding, unmanaged lands. Currently, many widespread alien plant taxa cannot be completely eradicated from Kauai, and therefore are expected to continue dispersing into previously managed areas (Loope 1998, Smith 1985). The remaining unmanaged populations of *C. remyi* var. *remyi* are still impacted by this threat.

In addition, taxa like *Chamaesyce remyi* var. *remyi* that are endemic to a single small island are inherently more vulnerable to extinction than widespread species because of the higher risks posed to a few populations and individuals by genetic bottlenecks, random demographic fluctuations and localized catastrophes such as hurricanes and disease outbreaks. When considered on their own, the natural processes associated with being a single island endemic and the habitat perturbation caused by hurricanes do not affect *C. remyi* var. *remyi* to such a degree that it is threatened or endangered with extinction in the foreseeable future, but these natural processes can exacerbate the threat from anthropogenic factors, such as habitat loss for human development or predation by alien species. With only ten populations remaining, stochastic events, such as hurricanes, also threaten this variety (S. Perlman and K. Wood, pers. comms. 1996).

CONSERVATION MEASURES PLANNED OR IMPLEMENTED

The Service has provided funding to the Waipa Foundation, a non-profit grassroots community organization on Kauai, and work has begun on riparian and coastal restoration at four sites within Lumahai Valley. The riparian site(s) will provide protection to *Chamaesyce remyi* ssp. *remyi* and other rare plants, through weed control and outplanting (The Nature Conservancy 2005a). The Service has also provided funding to The Nature Conservancy for fencing and weed control of Wahiawa Bog, which will benefit this species (The Nature Conservancy 2005b).

SUMMARY OF THREATS:

The major threats to this taxon are pigs, goats, the nonnative two-spotted leaf hopper, and nonnative plant species, which are believed to be a major cause of the decline of this species throughout its range. Feral pigs and goats have been fenced out of two of the ten populations where *Chamaesyce remyi* var. *remyi* currently occurs, but the fences must be continually maintained to prevent incursion. Nonnative plants have been reduced in the two populations that are fenced. These on-going conservation efforts for this species benefit only two of the ten known populations. The eight unmanaged populations are still impacted by these threats. Long-term monitoring and management will be required to maintain threat free areas.

LISTING PRIORITY:

THREAT			
Magnitude	Immediacy	Taxonomy	Priority

High	**Imminent**	Monotypic genus	1
		Species	2
		Subspecies/population	**3***
	Non-imminent	Monotypic genus	4
		Species	5
		Subspecies/population	6
Moderate to Low	Imminent	Monotypic genus	7
		Species	8
		Subspecies/population	9
	Non-imminent	Monotypic genus	10
		Species	11
		Subspecies/population	12

Rationale for listing priority number:

Magnitude:

This species is highly threatened by goats and pigs that degrade and destroy habitat and potentially prey upon individuals of *Chamasyce remyi* var. *remyi*, by the two-spotted leafhopper that causes leaf damage and may spread viruses, and by nonnative plants that outcomplete and displace it. Threats to the montane mesic forest and lowland rainforest habitat of *C. remyi* var. *remyi* and to individuals of this species occur throughout its range, and are expected to continue or increase without their control or eradication. Feral pigs and goats have been fenced out of two of the ten populations where *Chamaesyce remyi* var. *remyi* currently occurs, but the fences must be continually maintained to prevent incursion. Nonnative plants have been reduced in the two populations that are fenced. These on-going conservation efforts for this species benefit only two of the ten known populations. The unmanaged populations are still impacted by these threats and all populations are threatened by the two-spotted leafhopper. Long-term monitoring and management will be required to maintain threat free areas.

Imminence:

Threats to *Chamaesyce remyi* var. *remyi* from goats, pigs, and nonnative plants are considered imminent because they are ongoing in the eight populations that are not being managed. All populations are threatened by the two-spotted leafhopper.

Yes Have you promptly reviewed all of the information received regarding the species for the purpose of determining whether emergency listing is needed?

Is Emergency Listing Warranted?

No. The species does not appear to be appropriate for emergency listing at this time because the immediacy of the threats is not so great as to imperil a significant proportion of the taxon within the time frame of the routine listing process. *Chamaesyce remyi* var. *remyi* is currently known from 10 populations totaling 500 to 1,000 individuals on the island of Kauai. This species is threatened by feral pigs and goats, the two-spotted leaf hopper, and nonnative plants. If it becomes apparent that the routine listing process is not sufficient to prevent large losses that may

result in this species' extinction, then the emergency rule process for this species will be initiated. We will continue to monitor the status of *Chamaesyce remyi* var. *remyi* as new information becomes available. This review will determine if a change in status is warranted, including the need to make prompt use of emergency listing procedures.

DESCRIPTION OF MONITORING:
The information in this form is based on the results of a meeting of 20 botanical experts held by the Center for Plant Conservation in December of 1995. We have incorporated additional information on this species from our files and the most recent supplement to the *Manual of the Flowering Plants of Hawaii* (Wagner and Herbst 2003). In 2004 the Pacific Islands office contacted the following species experts: Bob Hobdy, retired from Hawaii Division of Forestry and Wildlife; Joel Lau, Hawaii Natural Heritage Program; Art Medeiros, U.S.G.S. Biological Resources Discipline; Hank Oppenheimer, resource manager for Maui Land and Pineapple Company; and Steve Perlman and Ken Wood, National Tropical Botanical Garden. Dave Lorence and Ken Wood provided new information in 2004. In 2005, we contacted the species experts listed below and confirmation of the status information was provided by Ken Wood.

The Hawaii Natural Heritage Program identified this species as critically imperiled (Hawaii Natural Heritage Program Database 2004). Based on the International Union for Conservation of Nature and Natural Resources Red Plant Data Book rarity categories, this species is recognized as Rare (could be considered at risk) by Wagner *et al*. (1999b).

One species expert provided new information confirming the status of the species this year and the results are included in this assessment.

COORDINATION WITH STATES:
In October 2004 we provided the Hawaii Division of Forestry and Wildlife with copies of our most recent candidate assessments for their review and comment. Vickie Caraway, the State botanist, reviewed the information for *Chamaesyce remyi* var. *remyi* and suggested that this taxon may meet the interim recovery objectives for Hawaiian plants, and therefore may not warrant listing (V. Caraway, pers. comm. 2005). The interim recovery objectives for a short-lived species such as this taxon are aimed at stabilizing the species and preventing extinction in the near future, and include 1) the existence of 3 populations of 50 reproducing individuals each, 2) all threats managed and, 3) the species in genetic storage. While the population numbers may meet the interim recovery objectives, the threats to *C. remyi* var. *remyi* are being managed in only two of the ten populations, and this variety is not currently in genetic storage. Therefore, we believe listing is warranted for *C. remyi* var. *remy.*

LITERATURE CITED

List all experts contacted:

Name	Date	Place of Employment
1. Joel Lau	June 28, 2005	Hawaii Natural Heritage Program
2. Art Medeiros	June 28, 2005	U.S.G.S. Biological Resources Discipline
3. Jim Jacobi	June 28, 2005	U.S.G.S. Biological Resources Discipline
4. Rick Warshauer	June 28, 2005	U.S.G.S. Biological Resources Discipline
5. Hank Oppenheimer	June 28, 2005	Maui Land and Pineapple Company

6. Kapua Kawelo	June 28, 2005	U.S. Army
7. Dave Lorence	June 28, 2005	National Tropical Botanical Garden
8. Steve Perlman	June 28, 2005	National Tropical Botanical Garden
9. Ken Wood*	June 28, 2005	National Tropical Botanical Garden
10. Marie Bruegmann	July 13, 2005	U.S. Fish and Wildlife Service
11. Vickie Caraway	June 14, 2005	Hawaii Division of Forestry and Wildlife

*Provided new information on this taxon in 2005

List all databases searched:

Name	Date
Hawaii Natural Heritage Program	2004

Other resources utilized:

Center for Biological Diversity, Dr. Jane Goodall, Dr. E.O. Wilson, Dr. Paul Ehrlich, Dr. John Terborgh, Dr. Niles Eldridge, Dr. Thomas Eisner, Dr. Robert Hass, Barbara Kingsolver, Charles Bowden, Martin Sheen, the Xerces Society, and the Biodiversity Conservation Alliance. 2004. Hawaiian Plants: petitions to list as federally endangered species. May 4, 2004.

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Hawaii, Department of Land and Natural Resources. N.d.-c. Summary of Title 13, Chapter 123, Game mammal hunting rules, island of Maui. Division of Forestry and Wildlife, Honolulu. 2 pp.

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APPROVAL/CONCURRENCE: Lead Regions must obtain written concurrence from all other Regions within the range of the species before recommending changes to the candidate list, including listing priority changes; the Regional Director must approve all such recommendations. The Director must concur on all 12-month petition findings, additions of species to the candidate list, removal of candidate species, and listing priority changes.

Approve: Acting _____
Regional Director, Fish and Wildlife Service

11/16/05
Date

_____

Concur: _____ August 23, 2006
Director, Fish and Wildlife Service Date

Do not concur: _____ _____
Director, Fish and Wildlife Service Date

Date of annual review: September 19, 2005
Conducted by: Marie M. Bruegmann, Pacific Islands FWO
Plant Recovery Coordinator

Comments:
PIFWO Review

Reviewed by: Christa Russell Date: September 20, 2005
Plant Conservation Program Leader

Gina Shultz Date: October 14, 2005
Assistant Field Supervisor,
Endangered Species

Patrick Leonard Date: October 14, 2005
Field Supervisor